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C-A OPERATIONS PROCEDURES MANUAL

10.2 Response to Tritiated Water Spills

Text Pages 2 through 6

Attachments

Hand Processed Changes

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Approved: _____ Signature On File _____
Collider-Accelerator Department Chairman Date

E. Lessard

10.2 Response To Tritiated Water Spills

1. Purpose

This procedure establishes controls for the Collider-Accelerator Support (CAS) Technicians and Water Systems staff to prevent a release of tritiated water to the sanitary system, the recharge basins, or directly on the ground.

1.1 Definitions

- 1.1.1 Primary-water: Several dedicated primary-water cooling-systems are distributed throughout the magnet enclosures, supplying cooling water to magnets and rf cavities. The term primary-water is meant to imply that there is a potential to activate the water. A network of trenches in the experimental areas collects leaks from primary-water systems. Primary water entering the trench system is in most cases conducted to the sanitary sewer system after first being collected in sumps. If primary-water is collected in sumps, then sump-pumps MUST to be turned off in order to analyze primary-water before discharge.
- 1.1.2 Chain-Of-Custody: Before disposal, spilled primary-water must be sampled for radioactivity. Water samples are obtained using "Chain-Of-Custody" formality and are labeled to identify date, building no., and system name.
- 1.1.3 Dissolved radio-gases: Radioactive gases are created in primary-water. Less than a fraction of a percent of the gas will become airborne even if the water is exposed to air. However, water pipes and water vessels represent short-term direct-radiation hazards, if these gases are present in the circulating water. Typical radiation levels near the C-line cooling skid are 200 mrem/h during proton running. Waiting 10 minutes following shutdown of a beamline or shutdown of the accelerators will eliminate the hazard. The following radioactive gases are found in primary water, with O-15 being the most abundant.

Nuclide	O-14	O-15	N-13	C-11
Half life, minutes	1.2	2.1	10	20

- 1.1.4 Tritiated-water-spill: Any unintended release of primary-water. Primary-water in cooling systems may contain 12.3-year half-life tritium and trace amounts of other shorter-lived radioactivity. With the exception of experimental-area cooling towers, primary-water systems are closed and are always sampled before release.

1.1.5 The following is a tabulation of tritiated primary-water systems.

AGS Primary Water System Name	Approximate Volume, gallons	Expected Tritium Concentration $\mu\text{Ci/mL}$
AGS Main Magnet System	20,000	3E-04
AGS Chilled Water	1000	3E-05
AGS Fast Quad	1000	6E-05
AGS RF Cavity	1000	1E-05
AGS RF Power Amplifier	2500	3E-04
AGS Special Experimental Magnet (SEM)	2000	2E-03
Linac Transport	1000	1E-05
Linac Tank	1000	2E-05
BLIP Beamstop	750	1E-03
Booster Magnet and Amplifier	2000	2E-04
Booster RF Cavity	500	7E-05
AGS F10 And F10 Cooler	500	5E-05
C Line Special Cooling (Pump Skid)	400	9E-05
V Line	1000	2E-03
RHIC Injection, X and Y	1000	MDL*
AGS Tower #1	15000	MDL
AGS Tower #2	2000	MDL
AGS Tower #3	2000	MDL
AGS Tower #4	15000	MDL
AGS Tower #5	10000	MDL

*MDL (Minimum Detection Level) is $3.3\text{E-}06 \mu\text{Ci/mL}$ for tritium.

2. **Responsibilities**

- 2.1 All CAS personnel who respond to primary-water spills are responsible for following this procedure.
- 2.2 The ESHS Division Staff assigned to C-A must assist in determining the radiological controls needed to prevent the spread of radioactivity either to personnel or to the environment.

3. **Prerequisites**

- 3.1 Personnel working under this procedure must be trained CAS Technicians or trained Water Systems personnel.

4. **Precautions**

None.

5. **Procedure**

Note 1:

According to DOE, potential for 100 mrem is an event level at which internal dose assessment including bioassay (urine sampling) must be performed when a worker is exposed to contamination. The most active contaminated cooling water at C-A is the V-target cooling water. Drinking 200 gallons of V-target water, will deliver 100 mrem. If you are soaked from head-to-foot with V-target water, your dose from tritium would be much less than 1 mrem.

Tritium taken in the body is eliminated in urine and sweat with a biological half-life of 10 days. Tritium is uniformly distributed throughout all the soft tissue, and it would deliver a whole-body dose. The whole-body dose from a tritium intake is assessed by measuring the tritium output in urine. Accurate estimates of dose can be obtained weeks after an intake, and doses as small as a fraction of a mrem can be easily detected.

Note 2:

Public concern has been associated with unintentional release of low-level amounts of tritiated water from C-A. Thus, the following procedure is aimed at controlling tritiated water releases, releases that may be as simple as a few gallons of primary water from a broken water hose.

You may be asked to minimize your own exposure by wearing protective clothing. We must report to DOE all events that result in contamination of skin or street cloths, even if the contamination leads to zero dose.

5.1 FOR THE SEM SYSTEM: IF a water mat alarms or IF a magnet power supply trips off on water flow, THEN

5.1.1 confirm the magnet power supply is off, and

5.1.2 valve-off the magnet's water-supply.

Note:

Locations for manifolds are shown on the map in [C-A OPM ATT 10.2.a](#). Magnet water supplies can be valved-off at these manifolds.

- 5.2 IF the valve
 - 5.2.1 does not shut the water off, or
 - 5.2.2 the water cannot be safely shut off, or
 - 5.2.3 the leak is at the manifold, or
 - 5.2.4 the leak is in the 4-inch piping that feeds the manifold,
 - 5.2.5 THEN contact the MCR Operations Coordinator (OC) and ask that the pumps to SEM be turned off.
 - 5.2.5.1 IF the MCR is not manned, THEN contact the Water Systems Group Leader, or ESHQ Division Head, or designee.
- 5.3 FOR THE C-LINE COOLING SKID OR AN SEM SYSTEM LEAK: Assess the leak and determine if spilled water is entering a trench or a floor drain.
 - 5.3.1 IF water is entering a trench or a floor drain, THEN turn-off the sump pumps to the sanitary-system lift-stations.

<p style="text-align: center;">Note:</p> <p>Locations for sump-pump disconnects are shown on the map in C-A OPM ATT 10.2.a. Sump pumps can be turned off at these disconnects.</p>

- 5.3.2 IF SEM is turned off, THEN call in C-A Water Systems personnel.
- 5.4 IF a spill occurred in SEB OR FEB experimental areas, THEN contact the on-duty C-A Radiological Control Technician (RCT) (x4660).
 - 5.4.1 HAVE C-A RCT determine if protective clothing is required to clean up the area or perform repair work. Direct contact with C-A cooling water does not represent a contamination hazard due to very low levels of radioactivity. However, simple precautions such as gloves and shoe covers shall be used.
- 5.5 COLLECT a 1 liter sample of the spilled water in a clean container and attach a "Chain of Custody" form. A "Chain of Custody" form is available from the C-A Environmental Coordinator (X7520) or the Radiological Controls Division (RCD) Representative (X4660). Sample containers are available from C-A Water Systems Group or CAS Supervisor.
- 5.6 IF the spill is on the ground OUTSIDE a building, THEN contact the MCR (x4662)

and request they implement the checklist in [C-A OPM ATT 10.1.d](#).

- 5.7 DETERMINE if repair work can proceed without causing further releases to the environment.
- 5.8 IF further significant releases to the environment are not likely, THEN MAKE necessary repairs and restore the system for operation as soon as possible.
- 5.9 SAVE and TAG any components replaced for future inspection.

6. Documentation

- 6.1 Any associated RWP records shall be maintained by the appropriate C-A Radiological Control Coordinator.
- 6.4 IF the checklist in [C-A OPM ATT 10.1.d](#) is used, THEN that checklist shall be kept by the MCR.

7. References

None.

8. Attachments

- 8.1 [C-A-OPM-ATT 10.1.d](#) "Operator Response to C-A Water Spills"
- 8.2 [C-A OPM ATT 10.2.a](#), "Maps Of SEM Manifolds And Sump Pump Disconnects In Building 912."